

NASA TECH BRIEF

Manned Spacecraft Center



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Experimental Study Of Surface Cracks

An experimental study was conducted to analyze the plastic zones surrounding surface cracks in stressed steel and titanium plate. The investigation was undertaken to determine the stability, surface deformation characteristics, and extent of plastic yielding associated with the surface cracks when the plates were subjected to tensile loading.

Interferometry, etching, polishing, and extensometer techniques provided visualization of the flow regions surrounding the cracks. Laser illumination was coupled with Michelson interferometry to characterize the residual surface deformation field in the small regions adjacent to the crack tips. The same areas were also photographed with diffused laser light to show the visual surface appearance. A spinning diffuser was introduced into the light path for this purpose.

A significant finding showed that back surface dimpling develops at stress levels considerably lower than those predicted by theoretical models of yield zone penetration into the back surface. Back surface dimpling may be an effective approach to predicting imminent failure in operating aircraft, machinery, and pressure

vessels. Furthermore, interferometric detection of dimples may be adaptable to automated control.

Notes:

1. The following documentation may be obtained from:
National Technical Information Service
Springfield, Virginia 22151
Single document price \$3.00
(or microfiche \$0.95)

Reference:

NASA-CR-114934 (N71-24820), Experimental Study of Plastic Yielding at the Tip of Surface Flaw Cracks.

2. Technical questions may be directed to:

Technology Utilization Officer
Manned Spacecraft Center, Code JM7
Houston, Texas 77058
Reference: B72-10019

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